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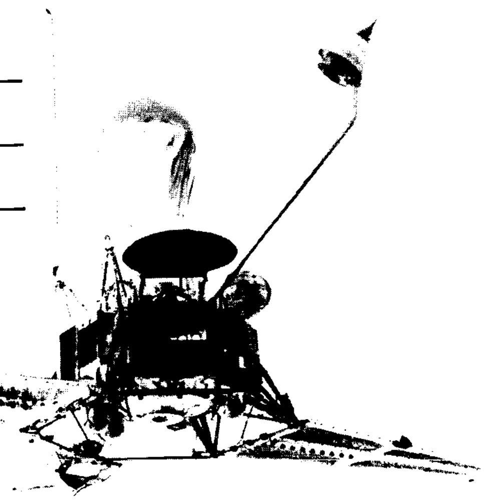

COMPILED BY: H. H. Reisenger
H. H. REISENGER

J. McGee for
M. K. MOORE
TEST DIRECTOR

JET PROPULSION LABORATORY
California Institute of Technology
Pasadena, California

TABLE OF CONTENTS

FIGURE

DISTRIBUTION LIST

Senior Staff

Burke, J. D.
Clausen, C. M.
Cole, C. W.
Cummings, C. I.
Eimer, M
Felberg, F.
Giberson, W. E.
Haglund, H. H.
Hibbs, A. R.
Howard, W. R.
James, J. N.
Kautz, G. P.
Meghreblian, R.
Morris, B.
Neiswanger, G.
Parks, R. J.
Pickering, W. H.
Rechtin, E.
Robillard, G.
Rose, R. F.
Schurmeier, H. M.
Sparks, O.

Barnett, M.
Boyle, M. J. (20)
Bruno, S. R.
Briglio, A.
Bronstein, L. M.
Cannova, R.
Casani, E. K.
Christensen, E. M.
Cotrill, H.
Crabtree, R.
Cramer, P.
Curtis, H. A.
Cushing, G.
Dallas, S. S.
Earle, G. W.
Emmerson, G.
Framan, E.
Fitzhugh, H. L.
Gates, C. R.
Gerpheide, J.
Goldfine, M. T.
Goodwin, F. A.
Eikelman, J. A.
Gill, W. F.
Guderian, C.
Hamilton, T.
Harker, R. B.
Heacock, R. L.
Hansen, R.
Headrick, E.
Henninger, G. J.
Hoover, W.
Hughes, D.
Jackson, J. G. (5)
Jacobson, N. F.
Johnson, M. S.
Katter, L.
Kehoe, J. J.
Keyser, J. H.
Kirsten, C.
Koukol, J. F.
Laub, J. H.
Laufer, J.
Lec, O. H.
LeFlang, W. G.
Levoe, C.
Levy, H. (10)
Linderman, E. O.
Long, J.
Lowe, A. R.
Lum, R. (2)
Lunine, L.
Madsen, P. C.
Margraf, H. J.
Malm, H. R.
McDonald, R. R.
McDonald, G. C.
McGee, J. F.
McKee, J. R.
Mesnard, M. R.
Moore, M. K.
Nalbandian, A. (5)
Paulson, J. J.
Porter, J. C.
Quinn, J.
Randolph, L. W.
Reisenger, H. (5)
Renzetti, N. A.
Richardson. H. A.

DISTRIBUTION LIST (Cont'd)

Schimandle, W. J.
Schneiderman, D.
Scull, J. R.
Shipley, W.
Sirri, N
Small, J. G.
Snyder, C. W.
Spaulding, J. G.
Stevens, R.
Strong, H. D.
Sweetnam, G. E.
Tardani, P. A.
Victor, W.
Wagner, H.
Walenta, I
Washburn, H. W.
White, G.
Wolfe, A. E.
Woods W. R.
Yamashiro, J.

A B B R E V I A T I O N S

S/C	Spacecraft
A/C	Attitude Control
COM	Communications
CCS	Central Computer & Sequencer
C/D	Command Decoder
D/E	Data Encoder
D/D	Data Display
C/R	Central Recorder
C/T	Central Timer
SCI	Scientific
RWV	Read, Write, & Verify
PYR	Pyrotechnics
SFA	Squib Firing Assembly
PWR	Power
MEC	Mechanical
T/M	Telemetry
T/D	Test Director
DRL	Data Reduction Lab
XPNDR	Transponder
M/C	Midcourse
MOIS	Missile Operations Intercommunications System
LC	Lunar Capsule
R/A	Radio Altimeter
STF	System Test Fixture

RTM	Running Time Meter
LCTT.	Launch Checkout Telemetry Trailer
F/F	Flip Flop
ADF	Aeroneutronics Division of Ford
CPCU	Commutator Program Control Unit

I INTRODUCTION

A. Purpose

The purpose of the FOM is to present both a prompt and technically complete record of the JPL/AMR field operations.

The FOM is, essentially, a comprehensive look at the JPL/AMR operations and, in addition, a quick look at the data on spacecraft performance available at the time of publication.

B. Scope

The scope of the FOM will be the JPL/AMR activities and events from arrival of the Spacecraft through its injection.

As defined, the FOM embraces only those operations accomplished by the Test Direction Team. Deep Space Instrumentation Facility (DSIF) activities and the postinjection performance of the Spacecraft will be documented, respectively, in the TOM and various Flight Evaluation Documents*.

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* Flight Evaluation Documents are listed in the Summary of Documentation Requirements for the Ranger Program EPD 11.

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II. ABSTRACT

From arrival of the RA-3 Spacecraft, on November 10, 1961, at the JPL Hangar on the Atlantic Missile Range, until the launch countdown, all activities with respect to the preparation, pre-launch, and final launch countdown took place within the anticipated operations schedule. The Ranger 3 flight scheduled for January 22, 1962, was postponed until January 26, 1962, in order to rework a damaged isolation bulkhead in the Atlas fuel tank. The Ranger flight vehicle RA-3, Agena B-6003, Atlas 121D was launched during the first countdown on January 26, 1962, at 1530:11.439 EST from Complex 12 at the Atlantic Missile Range. At launch all spacecraft subsystems were in operating condition.

During the boost phase of the launch, the GE guidance system pulse beacon on the Atlas failed at approximately T + 49 seconds. As a result, the GE ground guidance could not acquire the Atlas, thereby precluding the transmission of discrete commands to the Atlas. The following events which should have been commanded by discretes were initiated in the following manner:

Booster Engine Cutoff (BECO)

BECO was initiated by an acceleration switch.

Sustainer Engine Cutoff (SECO)

SECO was initiated by the propellant depletion switch (LOX).

Vernier Engine Cutoff (VECO)

VECO was initiated by the Atlas autopilot program.

Agena Timers

The Agena Timers were initiated by Atlas/Agena separation.

As a further consequence, the launch azimuth was not corrected to correspond with the actual launch time. The Atlas was programmed to, and did roll to an azimuth of 97.8° corresponding to launch plan 26G. Further azimuth correction to 97.3° which should have been effected in flight by the Burroughs computer and GE guidance was not accomplished due to the aforementioned failure.

The primary system objectives for this flight were:

1) Tracking and trajectory determination in real time

2) Spacecraft separation devices and separation monitors

3) Proper functioning of the following subsystems:

   a) Power

   b) Attitude Control

c) Central Computer and Sequencer

d) Temperature Control

e) Structures

f) Telecommunications and on-board data processing

g) Midcourse Propulsion

h) Scientific Instrumentation

i) Lunar Capsule

These objectives were achieved with two exceptions. First, the miss distance between probe and moon precluded the proper functioning of the retromotor part of terminal maneuver. Second, failure to impact prevented the Lunar Capsule from completing its mission.

III. JPL PRE-LAUNCH OPERATIONS

A. Schedule of Operations

Scheduled operations took place as indicated in Figure 1. The period of operations starts with the arrival of the S/C at AMR and finishes with the start of the Scheduled launch countdown.

B. Operations Summary

The RA-3 Spacecraft arrived at AMR on November 20, 1961. A complete receiving inspection did not disclose any spacecraft damage; however, several pieces of ground support equipment showed minor shipping damage. The systems test complex cabling was started November 20, 1961 and no major difficulties were encountered. The Gamma Ray GSE was modified to the extent that a new rack containing a punched tape and Sanborn Recorder was added.

During initial systems test preparation the midcourse motor fuel tank was charged to 150 pounds psi and the helium tank was charged to 500 psi. The pressurization was an attempt to gain a long term evaluation of tank leak rates. Several subsystem problems developed during the test periods. These problems are outlined in the text to follow.

During initial power turn-on at AMR several discrete failures were noted on the Data Display equipment. Some of the analog outputs to the Central Recorder failed during testing and were repaired. The Channel V discriminator had failed prior to System Test Number 5. The spare was not received at AMR in time to provide information during the Systems Test. A short circuit in the Data Display Console prevented the Data Encoder from controlling the decommutator inhibit function.

1. AMR Preliminary System Test (Spacecraft system test No. 5)

   This test was conducted on November 29, 1961. No additional problems were detected as the result of shipment. The test was performed with the S/C in flight condition except for the following known descrepancies:

   a) Non-flight Lunar Capsule and Radio Altimeter.

   b) Non-flight gyros and gyro electronics, secondary sun sensors, and earth sensor.

   c) Antenna Drive Module 7A3 was a flight spare.

   d) Power Module 4A4 S/N 7 replaced by S/N 8.

   e) Non-flight type batteries.

f) Antenna and cables were not used. These cables were not shipped with the other packaged cables to AMR.

g) Module 6A5 was non-flight.

h) Solar panels were not installed.

The following descrepancies noted during test are listed by subsystems:

Scientific

The Vidicon and Gamma Ray experiments performed normally during the Systems Test. However, a complete loop check could not be performed because the Channel V discriminator was not operating.

Power

Prior to system test No. 5, the communications converter developed a short circuit on the input 31.5 volt line due to a shorted power transister. A spare was available and testing proceeded without further problems. During the Systems Test, it was noted that the Data Encoder data mode would change on switching from external to internal power. A further investigation showed that this phenomena could be repeated intermittently. The problem was solved by the addition of swamping diodes across the internal/external power switch in the Command Circuit. Since the fix (ECO 2047) was implemented, no spurious mode changes were observed.

The telemetry measurements of the Solar Panel currents showed a difference of 0.5 amperes. Subsequent investigation of this difference showed that it is repeatable on an intermittent basis and appears to be a function of diode temperatures and the current drawn by the shunt regulating diodes. A system malfunction could not be detected.

Communications

Upon arrival at AMR the RF Drawer in the GSE remaining from the the RA-1 and -2 operations was modified and recalibrated. During the Systems Test one GSE power meter failed and erratic noise spikes were similar to those encountered during the RA-1 and -2 flight operations in Hangar AE. Further investigation of this problem revealed a poor grounding scheme which when corrected eliminated the problem.

Command

The transient noted on the switch from external to internal power also would trip a flip flop in the Command Detector; however, normal commands were transmitted without error.

Mechanical

The omni-boom extension event did not occur as the result of an alignment error in the omni-boom extension microswitch. Installation procedures have been modified to prevent a repeat of this problem.

Lunar Capsule and Radio Altimeter

These subsystems did not participate in Systems Test Number 5. Late delivery of the Lunar Capsule delayed Pyrotechnics interface checks.

Read, Write and Verify

This subsystem did not participate in System Test Number 5 because of GSE problems. These problems were resolved in the interim following system testing.

2. Spacecraft Sub-system Tests and Calibrations

Cabling

During initial subsystem testing, failure of the Scientific four (4) volt monitor appeared to be the result of an intermittent connection at the plug on Module 4A8.

Ground integrity checks were conducted on 6 December 1961. The following problems were noted and cleared:

a) The MOIS in the power GSE had zero ohms to the star ground (bent pin).

b) The range time clocks were putting a dc voltage to the star ground.

c) The Data Display Console was putting 40 volt ac on the star ground. (Reversing the ac cord in the Data Display rack cleared the problem).

Attitude Control

The Attitude Control leak rate checks were completed on 4 December 1961. The leak rate was established as 53 cc per hour as determined over 43 hours. This rate is within the specification.

Delivery of a flight gyro package (not sterilized) and Earth Sensor was expected on 8 December 1961, but did not arrive until 9 January 1962.

Data Encoder

Intermittent 120 cps amplitude modulation was observed on Channel 4 subcarrier. Trouble shooting did not uncover the cause, however, various changes in the GSE complex may have removed the problem as no observations of the phenomena reoccurred.

All telemetry calibrations were completed except for the gyro package and radio altimeter echo strength. These had to wait until flight units arrived.

3. Microscopic Inspection of Modules

A microscopic inspection of the RA-3 flight modules, and the RA-3 flight spare modules on 6 December 1961 revealed the following deficiencies:

Flight Modules:

Case	Module	Comment
Case 1 (CC&S and Command)	3A1	Cracked diode
	4A4	Broken diode
Case 3 (Scientific)	23A4	Chipped diode
	23A5	Broken diode
	23A6	Broken diode
Case 4 (Attitude Control)	7A2	Cracked diode
	4A3	Cracked diode

Flight Spares:

Case	Module	Comment
Case 1 (CC&S and Command)	4A12	Cracked diode
Case 3 (Scientific)	23A3	Broken diode
	23A5	Cracked diode
	23A6	Broken diode
Case 4 (Attitude Control)	4A3	Broken diode
	7A2	Broken diode
	7A21	Broken glass capacitor
Case 5 (Data Encoder)	6A4	Broken precision resistor

The amount of damage noted was considerably in excess of that which could reasonably be expected as a result of shipment. Corrective measures have been taken. Rework was started to have all flight modules in a flight-ready condition for the next system test on 12 December 1961. Rework on all modules except those in Case 3

(Scientific) was performed at JPL Pasadena. The scientific modules were reworked at AMR.

4. System Test Number 6.

The system test in Hangar AE for RA-3 was postponed from 9 December 1961 to 12 December 1961, due to the late delivery of the flight radio altimeter. The test was performed with the Spacecraft in flight condition except for the following known discrepancies:

a) Flight Solar Panels electrically but not mechanically connected to Spacecraft.

b) Non-flight gyros and gyro electronics. Command current modification was in Gyro Electronics.

c) Non-flight antenna yoke.

d) Non-flight battery.

e) ADF had no simulators for Bolt Cutters.

f) Pyro has a squib harness change due to be incorporated at a later date.

g) Several dents were noted in the Radio Altimeter Dish.

h) ADF was present with Flight Radio Altimeter and electrical mock-up of Lunar Capsule.

i) Earth Sensor temperature transducer was noted to be indicating in error. (Presumed to be a shift in resistance since original calibration.)

j) Telemetry for gyros and gyro electronics were not valid since flight packages were not installed. Radio Altimeter Echo strength channel uncalibrated. No Real Calibration for Earth Sensor and Sun Sensor channels on telemetry.

k) Antennas and cables were not used.

For System Test Number 6, Procedure P34R300.01-1, 5 December 1961, was followed with these exceptions:

a) Launch phase was abbreviated. CC&S commands were set manually. A/C performed exercises for Earth Sensor and Sun Sensor checks.

b) Spacecraft was held quiescent for approximately 30 minutes to allow LCTT to make data correlation checks between LCTT, Blockhouse, and Hangar Data Display installations.

flight configuration wiring. This condition resulted in a "noise" voltage at the SFA input presumably due to the varying current input to the booster-regulator. The adaptor cabling was modified such that simulation of the flight configuration was more closely approximated.

It should be noted that the flight squib harness (9W6/9W7) was not used during the System Test. This harness was not yet available. A functional change had been incorporated in the pyro subsystem to fix a probable mechanical interference between the radar altimeter antenna and the LC retro motor thermal shield assembly during retraction of the latter. The flight squib harness, fabricated according to the revised design, was received and installed prior to the final system test on RA-3.

Attitude Control

At one time the Antenna did not stop driving. The cause appeared to be adjustment of light source balance exciting the Earth Sensor pick up.

A/C GSE accelerometer counter failed.

Data Display

D/D did not have an operational CH 8 level detector to give service to Science GSE for Gamma Ray output via T/M.

In the Hangar GSE Loop for T/M CH B-19 there appeared to be an erratic operation. This was investigated by D/D and C/R at the earliest opportunity.

Two large transients appeared on CH B-20 and CH 8. D/D reported that the source of these transients had been explained and corrected.

Data Display was "Green" in all three areas (BH, LCTT, and AE), with exception of the CH 8 Level Detector used in D/D in Hangar for Gamma Ray GSE. Cards for this unit were returned to JPL Pasadena for rework and returned for January 3 tests.

Power

The Spacecraft as of this date had all flight acceptable power modules with the exception of 4A3 (A/C DC) whose temperature transducer had not been calibrated with D/E. This was due to the failure of a component in the original module which necessitated its replacement with a spare. Effort was made to repair this original unit and return it to the Spacecraft so that a recalibration of this channel would not be necessary.

Due to the discovery of broken components in several power modules, there was not a complete set of flight spares at this

c) Second Pitch maneuver was set for 30 second duration to allow A/C to get indication of Gyro Loop recovering from saturation.

d) The terminal phase was modified to accommodate test of flight Radio Altimeter.

The following discrepancies are listed by subsystems:

Scientific

Prior to System Test Number 6, the flight spare scientific commutator (29A1) SN3 had to be substituted for the flight unit, SN2, due to a failure. The spare commutator was designated as the flight unit and SN2 was returned to the JPL Lab for repairs.

A microdot cable to the Gamma Ray was found open during test. Temporary repairs were made for test and permanent repairs accomplished following test.

Telemetry Channel V was being overdriven by Vidicon input signal to Data Encoder. Later investigation indicates that there is a phenomena defined as "Vidicon Bounce" at the start of scan sequence, and there may be a synchronizing problem of commutating Vidicon with Gamma Ray which appears to allow erase voltages to appear at the end of scan. Both situations were investivated and resolved.

Command Decoder

During "Conditional Midcourse Motor turn-on" portion of test, C/D noted a blip on the C/D output. Later tests could not repeat this indication.

Lunar Capsule

Due to a conflict of power sources to the RA before and after RA "Turn-on" command the Radio Altimeter test had to be accomplished 13 December 1961. ADF noted that unexplained transients exist on telemetry output. ADF investigated since the source appeared to be the RA output to telemetry.

Pyrotechnics

Pyro event SFA 5a delay from CC&S command was different on substitute battery than with external supply. Because of external lash up to substitute battery, there was noise on the power input that affected or falsely triggered the SFA. This problem was found to be due to the lack of a sufficiently valid simulation of the Spacecraft internal power condition. The adaptor cabling to the lead-acid battery used was sufficiently long so that the impedance of the wiring was higher than the specified design value of the time. These were repaired and an additional set of spares was sent to AMR to make 200% spares available.

Data Encoder

a) Spacecraft

A re-check of the Channel "V" Gamma Ray blackbox calibration did not agree with the original. Channel "V" Vidicon and CH 8 Gamma Ray blackbox calibrations did agree with original. The channel was re-calibrated and closely monitored.

Final calibrations of the Altimeter Echo Strength channel had to wait for DBM versus voltages data.

b) Blockhouse GSE

Commutator Program Control Unit (CPCU) was unable to actuate relay in programmer control module due to large amount of capacity in cables from blockhouse to umbilical tower. This problem was remedied by driving a relay with a dc supply. CPCU failed to reset counter in CPCU. Retest of both CPCU problems was accomplished after installation of dc supply.

Central Recorder

C/D Channel at C/R indicated "Real Time Commands" appeared to be overdriven or a gain set improperly. Tests on the following day indicated that the problem had been corrected or that the problem had disappeared.

Cabling

The problem of the missing cable mentioned under System Test Number 5 was resolved by fabricating the two cables at AMR.

First checkout of the Launch Complex showed only two problems:

a) "C" sync would not work.

b) Mode would not change.

These were corrected, but not checked out. The complete checkout of the Launch Complex was completed 18 December 1961.

Inspection

A microscopic inspection was performed on RA-3 on 12, 13, and 14 December 1961. The following rejects were found on the flight hardware:

a) 6A14 S/N 2 - Broken diode.

b) 4A3 S/N 005 - Broken diode.

c) 6A4 S/N 2 - Leaking capacitor.

All flight cables were inspected and checked out for damage. The only cable rejected was 9W14 Attitude Control. The reason for rejection was due to potting compound between sockets and inserts of connectors, which destroyed all retention of locking devices. Cable is now being held in AMR stock room.

5. Spacecraft Flight Preparation

During the period from 15 December to 22 December 1961, final pre-flight mechanical preparation of the basic Spacecraft hex was completed. This included:

a) Change from high-gain antenna test yoke to flight yoke.

b) High-gain antenna alignment verification.

c) Antenna drive servo pot mechanical/electrical alignment.

d) Complete hex tear-down and build-up.

e) General hardware up-dating.

f) Thermal control surface paint up-dating and extensive clean-up.

g) Reflective surface, associated with Earth Sensor reflectivity problem, modified.

h) Spacecraft/LMSC adaptor pre-load shim verification.

The following problems appeared at this time:

a) The Case IV critical reference surface was found irregular around mounting holes due to protective coating. This condition was reviewed with materials pesonnel.

b) Interdependancy of bay three shroud guide installation and Case III closed or open condition was noted. Field modification was performed on RA-3 shroud guide. The hex mounting is to be modified on future Rangers.

c) Materials/sterilization problem was found to exist in areas of Earth Sensor reflectivity. The sterilization requirements for the Earth Sensor were set aside due to schedule pressures; problem to be investigated.

d) A mechanical mating of the flight radio altimeter and retro support to the flight Spacecraft disclosed a somewhat minor mechanical interference problem between the altimeter support structure and a solar panel support leg. ADF noted discrepancy and reflected it into the design.

Vehicle center of gravity was re-evaluated and the midcourse motor, both flight and spare units, were aligned and pinned.

JPL/Lockheed Interface

A verification match-mate and spring constant determination was conducted between the flight Agena adaptor and Spacecraft. A minor decrease in the system (adaptor and Spacecraft) rigidity was noted and pre-load shim values were revised for flight.

Quality control inspection and Spacecraft simulator checks were performed to verify proper wiring of the adaptor cabling. Discrepancies were noted and reported to LMSC.

6. Special RF Checks

These remaining tests were completed before 3 January 1962:

a) Space loss measurements from RFT to Pad 12. Both Hi- and Lo-gain measurements plus 890 mc path. Plans were to run this test 2 January 1962.

b) Antenna Gain check and antenna cable loss measurements were made. VSWR measurements on both were made.

c) Complete checkout of RWV from Hangar AE to Launch Checkout Site and back. The video cables were in operation on 14 December 1961. Complete checkout followed on 15 December 1961.

Data Scanner and spare modulator were installed in the RF Trailer for emergency use only. This gear was in full operation by 20 December 1961.

A special RF Test was run from the Launch Checkout RF Trailer to the Explosive Safe Area. Setting up an antenna on top of the ESA and checkout Spacecraft from that area via RF link to RFT proved feasible. A pole beacon transponder was set up in ESA building and the RFT was in two-way lock with the transponder with the signal level varying ± 2 db.

7. Explosive Safe Area Operations

After the move to the Assembly and Sterilization Lab of the Explosive Safe Area, (18 December 1961), the final vehicle build-up was accomplished. The objective was to develop a valid, all inclusive (electrical/mechanical; joint JPL/ADF) activity controlling procedure, verifying operations/facility compatibility, education of assembly personnel and establishing valid time estimates for the various operations were met with a minimum of compromise. The following problems were noted:

a) Lower-than-desirable hook height caused minor handling problem. The handling equipment is to be modified.

b) A static low voltage noted during squib firing assembly no voltage checks which may have been due to battery simulator hook-up.

c) Undesirable lifting fixture instability was noted during composite vehicle handling. As a result a secondary sling system is to be added to the handling fixture.

d) An improper circuit indication was noted on capsule separation sensor which was traced to miswiring. The spare unit was corrected and the flight unit was corrected prior to final System Test.

During the ESA Spacecraft checkout, the CCS clear function failed as the result of poor contact at the connector. This connector was not fastened as it would be in the flight configuration. After this test the Spacecraft was moved to the pad (Complex 12) for mating with the Agena B.

8. Precountdown Number 1

The test was completed with only Data Encoder reporting any malfunction.

The commutator failed to step as the result of additional launch complex cable capacity on the "C" sync line. Visual inspection of Module 6A6 S/N 3 detected a capacitor with nicked leads. Another capacitor in Module 6A6 S/N 3 was incorrectly wired. The Module was replaced with S/N 5.

9. Precountdown Number 2

The following descrepancies were noted and are listed by subsystems:

Command Decoder

Command decoder threshold were inconsistent with previous tests. A check of the temperature under the shroud revealed that the measured threshold level was normal for the existing ambient conditions.

Communications

The spacecraft transponder went out of lock at -90 dbm. Tests indicated that the prototype lunar capsule was radiating sufficient energy near the spacecraft receiver frequency to noticeably effect threshold capabilities. This problem was investigated with the flight capsule at the conclusion of this test.

Data Encoder

Engineering measurements revealed that the helium tank temperature transducer had failed.

A temporary capacitor was added to the "C" sync line at the Blockhouse to allow commutator operation in the Launch Complex.

10. J-Fact

Communications

The spacecraft transponder lost lock intermittently around T-5. It appeared that the problem was the result of personnel moving in the vicinity of the slot antenna and the reduced threshold capabilities created by the Lunar Capsule radiated spectrum. Special Lunar Capsule tests were indicated.

11. Special Lunar Capsule Tests

Following is a tabulation of problems noted during ADF Lunar Capsule interference to transponder receiver threshold tests:

January 4, 1962 - During J-FACT Precountdown observation was noted of degraded receiver threshold to approximately -90 dbm from -138 dbm. After test it was positively determined that ADF Capsule (mockup) power ON was the cause of threshold degradation.

January 5, 1962 - After the Countdown exercise, the Spacecraft was returned to Hangar AE with the Spacecraft shroud on and mated with the LMSC adaptor. AGC measurements were made with LC power OFF and power ON. Essentially the same degradation of transponder receiver theshold was noted.

Spectrum measurements of the Lunar Capsule radiation were made with a Stoddart RFI receiver.

a) Hard line to low gain antenna quick disconnect, shroud on spacecraft.

b) Hard line to low gain antenna quick disconnect with shroud off and Omni in place

c) Hard line to low gain antenna quick disconnect with shroud off and Omni deployed

The spectrum showed the mock-up Capsule to be radiating energy at many frequencies and specifically near the transponder receiver frequency.

January 8, 1962 - The "Flight" Capsule # 10 arrived. Measurements of capsule radiation were made at "ESA" on Capsule alone with the Stoddart. It was noted that energy existed near the transponder receiver frequency, and that reversal of the (1)G field did not turn power off. The undesireable power at receiver frequency appeared to be less on the flight unit than on the "mock-up".

The flight capsule was then taken to Hangar AE and placed upon the spacecraft with no shroud, on test dolly, using system omni test probe (890 mc), and no solar panels. AGC runs were made with Capsule power turned on. The capsule was then removed from the Spacecraft and the test repeated. No degradation of transponder threshold was noted.

January 9, 1962 - Spacecraft was installed on adaptor and Forward Equipment Rack. AGC was measured with transponder "Lock Up" through the low gain RF hard line to Case II with directional coupler isolation of ground transmitter RF into the Omni antenna, with Capsule and shroud off the spacecraft. Then the Capsule was installed with the shroud on. AGC threshold indicated degradation to -125 dbm.

To prove out the reference AGC conditions, AGC was re-run with the capsule off and shroud on the spacecraft. Reference was proven and degradation proven to be due to capsule interference. Stoddart spectrum scan was made following AGC when capsule was installed.

Capsule "mock-up" was installed on the spacecraft without the shroud, and on system test dolly. AGC runs indicated threshold degraded to -106 dbm. Stoddart spectrum scan was made at 9W8P3 (low gain coax at Case II). Spectrum scans on "Flight" Capsule and "mock-up" Capsule were made in the screen room with supplementary RF equipment to obtain more accurate frequency data than afforded with the Stoddart receiver.

Additional tests were conducted with Capsule #10 from ESA. Tests were made in configurations of high-gain, low-gain transponder modes and with shroud ON and OFF. RF links were evaluated and test methods validated. It was concluded that interactions due to presence of Capsule #10 changed since previous testing and that receiver threshold degradation was serious under all configurations.

Extensive tests were made with Capsule #12 and interactions with transponder evaluated in all pertinent configurations. In addition, "Command Decoder" threshold was confirmed.

Spacecraft tests with Capsule #12 showed little degradation and with shroud off, no degradation was noted. Thus, it was decided to launch with Capsule #12.

12. System Test Preparation

Midcourse Motor

The midcourse motor capsule separation switch was rewired to conform to flight wiring.

The helium tank transducer that failed earlier was replaced.

The midcourse motor was released for sterilization.

Cabling

A new flight pyrotechnic harness was installed. The CC&S case harness S/N 5 was rejected because of poor pin retention in the connectors. A new case harness, S/N 13, was installed on January 9, 1962.

Attitude Control

The flight gyros, and gyro electronics, S/N 10 were installed on January 9, 1962.

Mechanical

Performed mechanical matchmate of the following:

a) Flight Spacecraft
b) Flight Capsule
c) Flight Retro Support
d) Flight Thermal Shield
e) Flight Midcourse (inert)
f) Flight Omni Antenna
g) Mock-up Retro Motor

Problems were noted in the following areas:

a) A problem existed in the area of the Omni Antenna squib leads and coax getting through the ADF modified support backing unit. The ADF unit was modified.

b) ADF could not readily complete the altimeter J-box to Retro Motor connection. ADF modified the Fiberglass backing unit.

c) The Thermal Shield for the Lunar Capsule and Lunar Capsule Support structure was modified to a more practical design.

13. System Test Number 7

This test was conducted on 11 January 1962. Ths Spacecraft was in flight-ready condition with the exception of the following:

a) No Retro Motor
b) No Squibs
c) No High-Gain Antenna
d) No Lunar Capsule
e) No Omni Antenna
f) Case III contained a non-flight Thermal Switch Simulator

The discrepancies noted during this test are listed by subsystems:

Attitude Control

During the test it appeared that measurements $3D_27$ and 2C4 were out of band. However, an investigation revealed that the rate table speed was excessive and the measurements were satisfactory.

CC&S

Right after the start of the test it was noted that the CC&S would not clear. The problem was traced to the GSE. The Blockhouse CC&S panel was substituted and testing continued. Later in the test it was noted that A4 came on when A3 was set. An investigation revealed that there was no problem, and that this occurrence was the result of a non-flight operating sequence.

Scientific

Gamma Ray received two readouts, back to back, separated by three seconds. This condition was probably caused by a spurious pulse causing the read/store bi-stable flip flop to return improperly to the read mode. This condition had not been previously seen, and operation after the incident appeared normal.

Midcourse Motor

Engineering measurement 4H8, helium tank pressure, read approximately 1800 psi during the test which was thought to be too high. However, a post system test pressure check revealed that this was indeed the pressure in the vessel at that time.

Thermal Control

All temperature transducers appeared normal except for number 76 (2G6) which appeared to have shifted two to three cycles (8-12 degress high). This condition in itself was not sufficient cause to hold schedule at that time. However, time and schedule permitting, it was requested that it be replaced.

During the period from January 13 to January 23, 1962, ESA preparation and build-up for Launch was made and Spacecraft verified ready to go to the Pad. Before transporting to the Pad, word was received of an Atlas failure that was to postpone Spacecraft requirement "Ready" until January 24, 1962. "Set Down" time was utilized in Capsule to transponder interaction studies, and the decision to use Capsule #12 was made.

During threshold checks on transponder receiver it was observed that CH 4 modulation developed severe noise spikes. At first it was thought to be a capsule interaction phenomena. It as since been determined that these spikes are a normal condition developed by modulation distortion when the receiver is operating near threshold signal. This condition has never been observed before because operations per procedure have always had "Data Display" operating from Encoder mixed signal "Hard Line" when threshold checks have been in progress.

During midcourse propulsion unit post-sterilization fill operations, difficulties were encountered in maintaining fuel bladder seal. The problem is believed to be caused by bladder seal area deformation during heat sterilization, and compounded by the increased fuel load. RA-3 unit used a non-heat sterilized bladder and fuel load was reduced to original 120 fps capability.

High-Gain antenna gear box sterilization hardware was found to be too bulky for ease of handling and did not provide desirable disconnect facility. The problem is under consideration and hardware modification will be attempted prior to RA-4 activity.

The build-up for Launch was again accomplished and Spacecraft made "Ready" on January 23, 1962.

14. Post System Test Number 7

It was noted that the Pitch Gyro Channel indicated an excessive rate unaccountable to "Earth Rate" and "Torquer Compensation". Subsequent consultations with Pasadena uncovered the fact that "Torquer Compensation" has been incorporated incorrectly in all Gyros. This condition was corrected on RA-3.

The Vidicon was sweeping more than 200 lines in a ten second interval. Approximately 210 lines were counted in two samples. Science cognizant personnel did not consider this to be a serious condition, at least not sufficient to interrupt the schedule for correction. Vidicon gain adjustment to telemetry was made to account for light conditions expected for the late window in the Firing period.

The following T/M Channels had minor discrepancies:

a) 2G6, Temp. Control Temp. appeared to have taken a small resistance offset.

b) 2D5, Fuel Tank Temperature. This transducer was replaced. There was no opportunity to do a "Real" Calibration. By transfer methods a new curve was calculated.

c) 2G4, Gyro Package Temp. Because of late arrival, this had not had a "Real" Calibration and transfer method described above was used.

Following System Test Number 7 it was discovered that Module 6A5 (Data Encoder) had not had ECO 2121 incorporated. Because of the reliable history of this unit and some reservations about the mandatory conditions of this ECO, it was decided to launch with this module rather than interrupt schedule.

During the period from January 24 to January 26, 1962 all items on the schedule were completed. Operations during this period included the F-1 Day Spacecraft Test, Launch, and a preliminary AMR Flight Evaluation in Mode I and III by the Launch Operations Group.

15. F-1 Day Test

With the exception of several known transducer calibration offsets, all subsystems were performing normally.

As the result of critical evaluations of the receiver threshold in the presence of the Lunar Capsule signal, some of the time allotments shown in the Test Procedures were insufficient for the work to be accomplished by RF personnel.

Receiver threshold with the low-gain systems was reported at -134 dbm and for High-gain system it was reported at -135 dbm.

16. Countdown

Flight Countdown Procedure for Ranger 3 started at 9:30 AM EST on January 26, 1962, with an intercommunications checkout of all stations. The Spacecraft was in flight configuration. (See Section V.)

The Spacecraft flight countdown was scheduled to start at 10:45 AM EST with time at T-205. Shortly before the scheduled start time, GD/A reported a 25 minute hold would be scheduled at T-205. This hold was later extended an additional 10 minutes. While holding at T-205, the RF and Telemetry Trailers lost critical power. An investigation indicated that additional loading of Television Equipment recently added to the critical power lines was the source of the power failure. Spare generator power was used for the Launch Operations.

At 11:16 AM EST the countdown was started at T-205. Several times during the countdown period, RF out of lock conditions were noted. Personnel and hardware motion around the Spacecraft were confirmed to be the source of the problem. The scheduled hold at T-5 was extended an additional 5 minutes for LOX toping of the Atlas. The Spacecraft was launched at 3:30 PM EST with all Subsystems normal. Spacecraft functions were monitored from Launch until the signal was lost over the horizon at T+7 minutes and 48 seconds.

IV. QUICK LOOK DATA

AMR RADAR TRACKING

The IBM 7090 Computer at the Impact Prediction Building was assigned to receive radar tracking data from the AMR downrange tracking stations and from the Damp Ship then compute acquisition information for the DSIF in South Africa and in Australia. Due to reasons outlined below, the computer did not receive the required tracking data therefore, this assignment was not achieved.

G. B. I.	Station 3	Loss of timing	Data not required
San Salavador	Station 5	Digital take-off equipment failure	No data
Antigua	Station 91	Digital take-off equipment failure	No data
Easter Island	Station 92	Transmitter failure	No data
Damp Ship		RF drop-out	Insufficient data
Ascension Island	Station 12	RF drop-out and operational error	No data

IV. QUICK LOOK DATA

POST LAUNCH MONITORING AT AMR

The Spacecraft arrived over AMR again early on January 27, 1962.

At 4:20 AM EST, the Spacecraft functions were monitored following a command switch to the High-gain antenna system by Goldstone.

In preparation for the midcourse maneuver, Goldstone again commanded the Spacecraft to the Low-gain antenna system; the RF Trailer at AMR lost the signal at 0500 AM EST.

Following the midcourse maneuver, AMR re-acquired lock on the Spacecraft High-gain antenna system.

Spacecraft operations were monitored until 1100 AM EST, when the signal was lost over the horizon.

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.					
Hi-gain Antenna	2A8	14	Feed #12	1A28 S/N 3	1A19 S/N 6	1A20 S/N 3
Lo-gain Antenna	2A9	10	Omni Boom S/N 6			
Solar Panel - Supports D & E	4A9/10	10		1A9 S/N 21		
Solar Panel - Supports A & B	4A9/10	9		1A9 S/N 19		
Solar Panel Evaluation Assy.	4A16	9				
Temperature Transducer	4TT6	8				
Panel 4A10 Front Temp. Trans.	4TT7	681				
Panel 4A10 Back Temp. Trans.	4TT8	672				
Panel 4A9 Front Temp. Trans.	4TT9	668				
Panel 4A9 Back Temp. Trans.	4TT10	765				
Antenna Drive Servo	7A8	13				
Earth Sensor	7A9	36	1A7 S/N 16			
Earth Sensor Temp. Trans.	7TT2	527				
Sun Sensor - Support B	7A10	AYR				
Sun Sensor - Support C	7A11	APR				
Sun Sensor (Pitch) Temp. Trans.	7TT4	768				
Sun Sensor - Support E	7A12	AYL	7TT6 S/N 628			
Sun Sensor (Yaw) Temp. Trans.	7TT3	576				
Sun Sensor - Support F	7A13	APL				
Sun Sensor (Pitch) Temp. Trans.	7TT5	633				
Sun Sensor - Solar Panel 4A9	7A14	3BY				
Sun Sensor - Solar Panel 4A10	7A15	3BP				
Attitude Jet & Valve Sub-assy.	7A6					
at Support C Valve - "G"	7A6A	6				
Jet Valve - "H"	7A6B	32				
Jet Valve - "J"	7A6C	69				
Attitude Jet & Valve Sub=Assy.	7A7					
at Support F Valve - "E"	7A7A	37				
Jet Valve - "F"	7A7B	11				
Jet Valve - "I"	7A7c	42				

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.						
Attitude Jet & Valve Sub-assy.	7A16						
at Support E Valve - "C"	7A16A	19					
Jet Valve - "D"	7A16B	31					
Attitude Jet & Valve Sub-assy.	7A17						
at Support A Valve - "A"	7A17A	56					
Jet Valve - "B"	7A17B	29					
Nitrogen Tank Pressure Trans.	7A18	8328	7TT1 S/N 650				
Panel 4A9 Unfold Squib - Sup. A	8SQ1	R-44	PP 413	1.46			
Panel 4A9 Unfold Squib - Sup. B	8SQ2	L-36	PP 231	1.41			
Panel 4A10 Unfold Squib - Sup. D	8SQ3	L-41	PP 415	1.43			
Panel 4A10 Unfold Squib - Sup. E	8SQ4	R-48	PP 433	1.52			
Lo-gain Antenna Deploy Squib	8SQ5	L-52	PP 245	1.57			
Lo-gain Antenna Deploy Squib	8SQ6	Deleted					
Boom Extension Squib	8SQ7	L-62	PP 686	1.63			
Helium Valve "Open" Squib	8SQ8	9101-823					
Helium Valve "Shut" Squib	8SQ9	9101-906					
Fuel Valve "Open" Squib	8SQ10	9101-836					
Fuel Valve "Shut" Squib	8SQ11	9101-952					
Oxidizer Valve "Open" Squib	8SQ12	9101-862					
Altimeter Deploy Squib	8SQ13	ADF Bolt Cutters		85Q14	L-35	PP248	1.39

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.					
Lo-gain Antenna Deploy Squib	8SQ25	R-56	PP 245	1.58		
Lo-gain Antenna Deploy Squib	8SQ26	Deleted				
Boom Extension Squib	8SQ27	R-31	PP 686	1.38		
Altimeter Deploy Squib	8SQ33	ADF Bolt Cutter	85Q34	R-44	PP 248	1.47
Case #5 - Data Encoder						
Data Encoder Converter	4A7	002				
VCO Module #1	6A1	2	VCO Chan. #3 S/N 15214		VCO Chan. #2 S/N 15208	
VCO Module #2	6A2	2	VCO Chan. #5 S/N 15225		VCO Chan. #4 S/N 15220	
VCO Module #3	6A3	3	VCO Chan. #6 S/N 15234			
Binary Oscillator	6A4	5				
Commutator #1	6A5	3				
Commutator #2	6A6	5				
Commutator #3	6A7	2				
Commutator #4	6A8	2				
Signal Conditioner	6A9	2				
DC Amplifier	6A10	3				
Data Coder	6A11	2				
Temperature Bridge #1	6A12	2				
Temperature Bridge #2	6A13	2				
Data Selector	6A14	2				
Case #5 Data Encoder Harness	9W15	2				
Case #5 - Casting						
Case #6 - Power						
Power Switching	4A1	002				
Boost Regulator	4A2	009				
Battery	4A15	12				
Battery Temperature	4TT1	794				
Squib Firing Assembly	8A41	005				
Case #6 - Power Harness	9W16	4				
Case #6 - Casting						

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.			
Panel 4A9 Unfold Sensor Sw.	8A69	Micro Switch No S/N		
Panel 4A10 Unfold Sensor Sw.	8A70	Micro Switch No S/N		
Boom Extension Sensor Sw.	8A71	Micro Switch No S/N		
Lo-gain Antenna Deploy Sensor Sw.	8A72	Micro Switch No S/N		
Capsule Separation Sensor Sw.	8A73	Micro Switch No S/N		
Main (Ring) Harness	9W1	2		
MC Ignition Harness	9W2	3		
MC Motor Harness	9W3	3		
Vidicon Cable - Assy. Elect. #3	9W4	4	9W5 S/N 10	
Squib Harness	9W6	9		
Squib Harness	9W7	9		
Coaxial Cable - Lo-Gain Antenna	9W8	D-1		
Coaxial Cable - Rotary Joint	9W9	9	Hex Cable S/N F-1	Rotary Cable S/N C-3
Coaxial Cable - Hi-gain Antenna	9W10	B-3		
Boom Harness	9W17	6	Dispenser S/N 8 Gamma Ray Boom S/N 6	
MC Transducer Harness	9W19	3		
Fuel Valve - Midcourse	10A1	9101974	1A23 - No S/N	
Helium Valve - Midcourse	10A2	9101739		
+Y Yaw Actuator	10A3	59A		
-Y Yaw Actuator	10A4	56A		
+X Pitch Actuator	10A5	58A		
-X Pitch Actuator	10A6	63A		
Oxidizer Valve	10A7	9101312		
Fuel Tank Pressure Trans.	10A8	8511		
Helium Tank Pressure Trans.	10A9	8505		

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature		Meas.			
Rocket Engine Wall Temp. Trans.		10TT1	31953		
Fuel Tank Temp. Trans.		10TT2	660		
Helium Tank Temp. Trans.		10TT3	661		
-Y Yaw Actuator Temp. Trans.		10TT4	648		
-X Pitch Actuator Temp. Trans.		10TT5	623		
Temperature Control Temp. Trans.		11TT1	679		
Gamma Ray Detector		23A1	005		
Gamma Ray Detector Pwr. Supply		23A2	003		
Gamma Ray Detector Temp. Trans.		23TT1	412		
Radio Altimeter		24A1	FP-1	25A6-S/N FP-2	
Radio Altimeter Support		24A2	FP-1	25A7-S/N 101, 102, 103, 104, 105, 106, 107, 108	
Launch Pedestal Junction Box		25A1	101	110, 111, 112, 113,	
Retro Motor		25A2	204	25A8-S/N 101	Bolt Cutters S/N 118, 152
Impacter Sphere		25A3	012	25A9-S/N 101	
Spin Motor		25A4	122	25A10-S/N 1	
Panel 4A9 Unfold Squib - Sup. A	8SQ21	L-52	PP 413	1.56	
Panel 4A9 Unfold Squib - Sup. B	8SQ22	R-42	PP 231	1.45	
Panel 4A10 Unfold Squib - Sup. D	8SQ23	R-67	PP 415	1.68	
Panel 4A10 Unfold Squib - Sup.E	8SQ24	L-63	PP 433	1.64	

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.		
Case #1 - CC, S, & Command			
Command Detector	3A1	5	
Command Decoder	3A2	4	
Communications Converter	4A4	003	
Command Converter	4A5	002	
CC & S Converter	4A6	002	
Power Sychronizing Supply	4A12	008	
Central Clock	5A1	003	
Maneuver Clock	5A3	003	5A2 S/N 003
Maneuver Duration	5A4	003	
Maneuver Output	5A5	003	
Accelerometer Integration	5A6	003	
Input Decoder	5A7	003	
Pulse Sequencer	5A8	003	
Transformer Rectifier CC & S	5A9	003	
Case #1 - I CC & S Harness	9W11	13	
Elect. Ass #1 Command Harness	9W18	5	
Case #1 - Casting			
Case #2 - Communications			
Transponder	2A1	15	2TT1 S/N 640
Transponder RF Driver	2A2	18-1	
Trans. RF Amp. Hi-gain	2A3	18-2	
Diplexer	2A4	8	
Trans. RF Amp. Lo-gain	2A5	7-2	
Hi-gain Antenna Monitor	2A6	15	
Lo-gain Antenna Monitor	2A7	15	
Antenna Transfer Switch	2A10	N/A	
Case #2 - Comm. Harness	9W12	7	
Case #2 - Casting			

V. RA-3 SPACECRAFT FLIGHT CONFIGURATION

Nomenclature	Meas.				
Case #3 - Scientific Inst.					
Scientific Converter	4A8	005			
Case #3 Scientific Inst. Harn.	9W13	5	9W20 S/N 3	9W21 S/N 8	9W33 S/N 2
Vidicon and Telescope	21A1	005			
Vidicon Deflection System	21A2	005	1A3 S/N 002		
Vidicon Power Supply	21A1	005			
Decoder (Gamma Ray System)	23A3	104			
Memory (Gamma Ray System)	23A4	104			
Programs (Gamma Ray System)	23A5	104			
Converter (Gamma Ray System)	23A6	104			
Analyzer Power Supply T.R.	23A7	104			
Case #3 - Casting			29A1 S/N 003	29A2 No S/N	
Case #4 - Attitutde Control					
Attitude Control Converter	4A3	002			
400 cps Single Phase Inverter	4A13	002			
400 cps Three Phase Inverter	4A14	002			
4A3 Temperature Transducer	4TT4	324			
Gyro and Capacitor	7A1	10			
Gyro Electronics	7A2	3			
Antenna Drive Electronics	7A3	4			
Switching Amplifier	7A4	3			
Auto Pilot Electronics	7A5	4			
Accelerometer	7A21	04			
Gyro Temperature Transducer	7TT7A	592			
Gyro Temperature Transducer	7TT1B	--Deleted			
Case #4 Attitude Control Har.	9W14	7			
Case #4 - Casting					

VI. LAUNCH COUNTDOWN

GMT	T-TIME	EVENT
1430		Communication check started
1437		Communication check completed
1534		Leased lines 9230-9239 are on Operations Center Control Console and established communications with Able and Charlie
1535		Temperature on shroud 70° F
1535		Anticipate hold at T-205
1545	-205	Picked up Range Count
1545	-205	Holding for approximately 25 minutes for installation of pyrotechnics on booster
1553		Station 91 Radar CNY
1554		Lost critical power at LCS
1556		Report LCS critical power loss to SRO 67 comp - 68 raw
1610		Hold extended an additional 10 minutes
1610		Digital feeding spurious to milgo 1002 radar still CNY Station 91
1615	-205	Picked up count after 30 minute hold
1620	-200	External Power on 23.5 volt dc
1624	-196	Inlet temperature to Blanket 40° F
1628	-191	DSIF/Patch on TTY no voice up as yet
1649	-171	Air conditioning off 4-5 minutes
1702	-158	Weather Report for T-6 hours 60% total, 46% bend, 36% useable Recommendation is GO
1725	-135	Station 91 Radar still CNY in Elevation Digital problems no estimate for fix. Station 92 (PR/Station 9) Microwave problems CNY

VI. LAUNCH COUNTDOWN

GMT	T-TIME	EVENT
1728	-132	Loop Test #1 GO
1730	-130	Completed Agena fuel tanking
1737	-123	Garbled Data from Damp Ship
1745	-115	Spacecraft Status GREEN
1749	-111	SRO gave GO for Station 92 (PR-9)
1758	-101	Gantry on transfer table for transfer to maintenance area
1800	-099	Damp ship data still garbled
1805	-094	Operational readiness report from Station A to GO condition
1807	-092	Station 92 is now out intermittent
1808	-091	Gantry in maintenance area
1815	-084	Following Spacecraft Frequencies were reported
		A. Transponder carrier frequency
		B. Ground transmitter 890 mc frequency
		C. Transponder 960 mc frequency at zero SPE volts
		D. Case II Temperature - 79° F
1833	-066	Station 92 GO. Station 91 Radar CNY
1840	-060	Hold for 40 minutes (Built in Hold)
1841	-060	Damp Ship in GREEN
1848	-060	Completed 100% IRFNA Agena tanking
1850	-060	T-3 hour weather total 64%, bending at Station 585 44%, useable 36% condition GO
1916	-060	All stations GO except Station 91 as noted above
1920	-060	Picked up count

VI. LAUNCH COUNTDOWN

GMT	T-TIME	EVENT
1934	-046	Space Flight operations in the GREEN
1948	-031	The following frequencies were reported: A. Transponder carrier frequency at 1932 GMT B. Ground transmitter 890 mc at zero SPE volts at 1925 GMT C. Transponder 960 mc frequency at zero SPE volts at 1925 GMT D. Ground transmitter 890 mc frequency at 1938 GMT E. Transponder AVE no-sig SPE voltage +0.35v at 1933 GMT F. Case II Temperature 82° F at 1928 GMT
1949	-030	Spacecraft in the GREEN
1954	-025	DSIF and SFO in GREEN
1955	-014	Rate 4-9 sync end
2010	-009	Case II Temperature 80° F at 1900 GMT
2015	-005	Launch plan 26F
2019	-005	Holding an additional 5 minutes Launch plan G 97.8° Az. Hold is for LOX toping
2025	-005	Counting
2026'5	-003'5	All stations GO
2030	11.439	Lift off 20 30 11.439 Station 1 - 1 way lock 2055:23 2 way lock 2056:55 Station 5 Acquire 2056:39 Station 4 Acquire 2129:50
2101:10		Event B2 - 2 from Station 5 B2 - 1 from Station 5

VI. LAUNCH COUNTDOWN

GMT	T-TIME	EVENT
2113		Took nine (9) minutes to acquire sun 43 minutes after lift off
2120		From SRO at somewhere between +10 and +30 seconds, station 92 transmitter dropped out. 91 tracked but no digital transmission. 12 acquired but spurious propagation. Damp same as above for 12
2152		Station 1, 4, 5 still tracking 4, 5 still in lock telecommunications channels
2155		Not a standard trajectory - much faster than anticipated
2320		Trajectory fast 50 hr transit below moon by estimated 40,000 kilometers
2329		Goldstone expects to acquire 0835 Z 27 January 1962
2348		DSIF/loosing lock
2349		DSIF reacquired

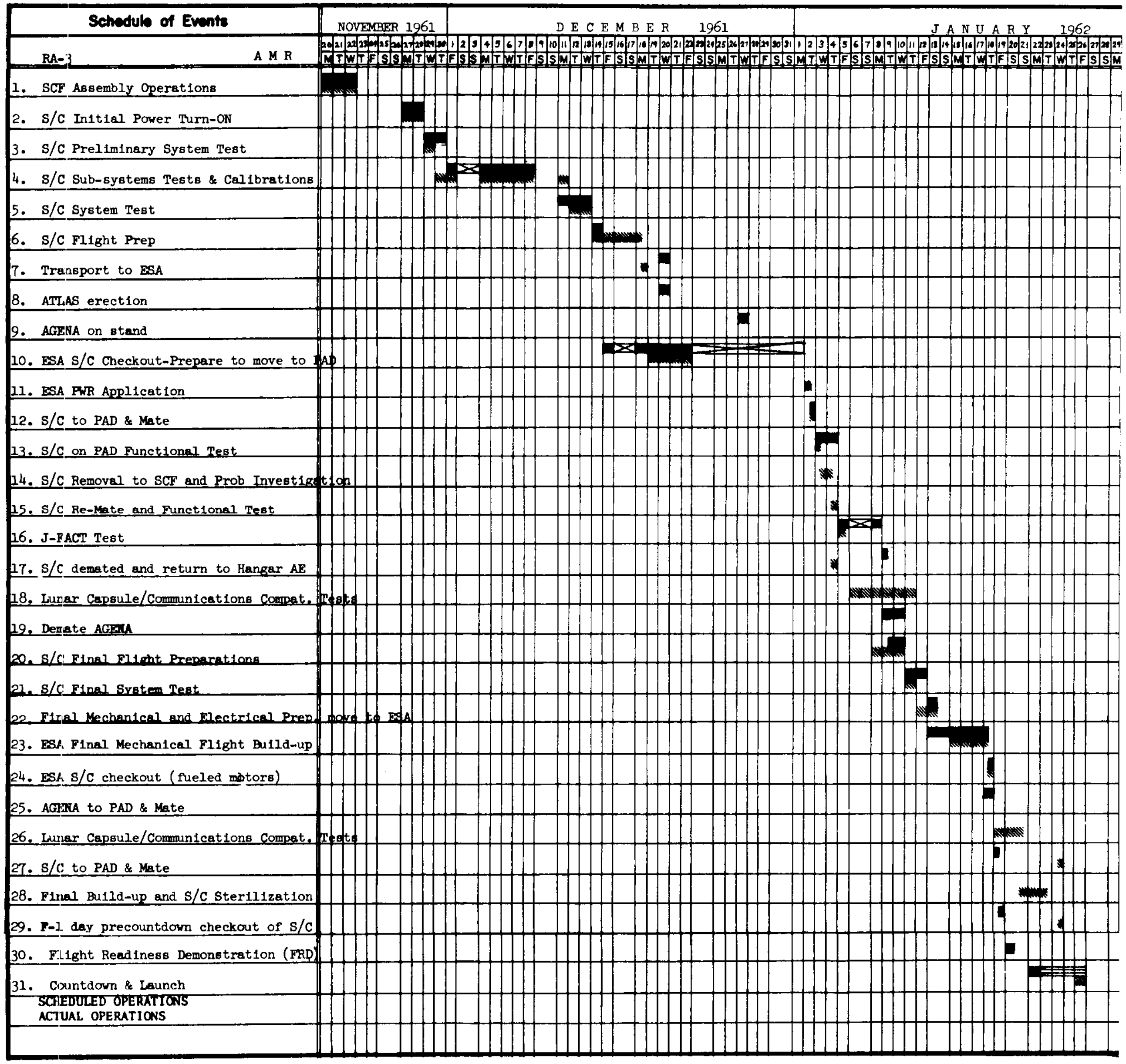

FIGURE 1. SCHEDULED JPL PRE-LAUNCH TEST OPERATIONS.